We claim:

1. A catheter for emitting x-ray radiation comprising:

a flexible catheter shaft having a distal end;

an x-ray unit coupled to the distal end, wherein the x-ray unit comprises an anode, a cathode and an insulator, wherein the anode and cathode are coupled to the insulator to define a vacuum chamber.

2. The catheter of claim 1, wherein the cathode is a field emission cathode.

3. The catheter of claim 1, wherein the catheter shaft comprises a coaxial cable.

4. The catheter of claim 1, wherein the insulator is chosen from the group consisting of beryllium oxide, aluminum oxide, or pyrolytic boron nitride.

5. The catheter of claim 1, wherein the cathode and the anode are coupled to a voltage generator.

6. The catheter of claim 1, further comprising a guide wire lumen.

7. The catheter of claim 6, wherein the guide wire lumen extends partially through the catheter shaft.

8. The catheter of claim 6, wherein the guide wire lumen extends partially through the x-ray unit.

9. The catheter of claim 1, further comprising a means for centering the x-ray unit within a lumen.

10. The catheter of claim 1, wherein the cathode is a ferroelectric material.

11. An x-ray catheter comprising:

a flexible catheter shaft for being advanced through lumens of the vascular system, the catheter shaft having a distal end;

an x-ray unit coupled to the distal end, the x-ray unit comprising an anode, a cathode and an insulator, wherein the anode and cathode are coupled to the insulator to define a vacuum chamber.

12. The catheter of claim 11, wherein the insulator comprises pyrolytic boron nitride.

13. The catheter of claim 11, wherein the anode comprises tungsten or platinum and the cathode comprises graphite.

14. The catheter of claim 11, wherein the cathode is a field emission cathode.

15. The catheter of claim 12, wherein the cathode and anode are coupled to a voltage generator.

16. The catheter of claim 15, wherein the catheter shaft comprises a coaxial cable coupling the anode and cathode to the voltage generator.

17. The catheter of claim 16, further comprising means for centering the x-ray unit within a lumen.

18. A catheter for the emission of x-ray radiation comprising:

a flexible catheter shaft having a distal end;

an x-ray generating unit coupled to the distal end, the x-ray generating unit comprising an anode, a cathode and

an insulator, wherein the anode and cathode are coupled to the insulator to define a vacuum chamber, and

wherein the x-ray generating unit has a diameter less than about 4 mm.

19. The catheter of claim 18, wherein the x-ray generating unit has a diameter of about 1 mm.

20. The catheter of claim 19, wherein the x-ray generating unit has a length of about 7 mm.

21. The catheter of claim 18, wherein the x-ray generating unit has a length less than about 15 mm.

22. The catheter of claim 18, wherein the insulator comprises pyrolytic boron nitride.

23. An x-ray catheter for use in irradiating the wall of a lumen comprising:

a flexible catheter shaft having a distal end;

an x-ray generating unit; and

means for centering the x-ray generating unit within the lumen.

24. A method for preventing restenosis of a lumen comprising:

(a) advancing an x-ray catheter through a lumen to a first location adjacent an intended site of the lumen, wherein the x-ray catheter comprises a flexible catheter shaft with a distal end and an x-ray generating unit coupled to the distal end, the x-ray generating unit comprising an anode, a cathode and an insulator, wherein the anode and cathode are coupled to the insulator to define a vacuum chamber;

(b) causing the emission of an effective dose of x-ray radiation to prevent restenosis; and

(c) removing the catheter.

25. The method of claim 24, wherein step (b) comprises causing the emission of radiation within a particular energy range to achieve a particular depth of penetration.

26. The method of claim 24, wherein the causing step (b) further comprises applying a predetermined voltage between the anode and the cathode to achieve the particular depth penetration.

27. The method of claim 24, further comprising irradiating tissue at a rate of about 1-50 grays per minute.

28. The method of claim 27, wherein the irradiating step is conducted for about 1 minute.

29. The method of claim 24, wherein step (b) comprises causing the emission of x-rays having an energy of about 8-10 KeV.

30. The method of claim 24, further comprising centering the x-ray unit within the lumen prior to the step (b).

31. The method of claim 24, wherein the advancing step comprises advancing the x-ray catheter through a lumen of the vascular system through an exchange tube.

32. The method of claim 24, wherein the advancing step comprises advancing the x-ray catheter through a lumen of the vascular system over a guide wire and through a guide catheter.

33. The method of claim 32, wherein a portion of the x-ray catheter is advanced over the guide wire.

34. The method of claim 24, further comprising positioning the x-ray unit at a second location and causing the emission of x-ray radiation at the second location.

35. The method of claim 24, further comprising positioning the x-ray unit at a plurality of locations and causing the emission of x-ray radiation at each of the plurality of locations.

36. The method of claim 24, further comprising conducting an angioplasty procedure prior to step (a), wherein the intended site of step (a) is the site of the angioplasty procedure.

37. A method for providing x-ray radiation treatment comprising:

advancing an x-ray catheter through a lumen to an intended site, wherein the x-ray unit comprises a flexible catheter shaft with a distal end and an x-ray generating unit coupled to the distal end, the x-ray generating unit comprising an anode, a cathode and an insulator, wherein the anode and cathode are coupled to the insulator to define a vacuum chamber;

causing the emission of an effective dose of x-ray radiation; and

removing the catheter.

38. The catheter of claim 2, wherein the cathode is chosen from the group consisting of graphite, titanium carbide, carbides, metals, and graphite coated with titanium carbide.

39. The catheter of claim 1, further comprising a guide wire lumen extending through the catheter shaft.

40. The catheter of claim 2, wherein the cathode comprises silicon and the x-ray unit further comprises a grid proximate the cathode.

41. The catheter of claim 2, wherein the cathode comprises silicon needles.

42. The catheter of claim 11, wherein the x-ray unit irradiates tissue at a rate of at least about 1 gray per minute.

43. The catheter of claim 1, wherein the anode is coupled to a wall of the insulator, wherein the wall is tapered towards the anode.

44. The catheter of claim 3, wherein:

the coaxial cable comprises an outer conductor and a central conductor;

the insulator has a tubular portion with proximal and distal ends, the coaxial cable being coupled to the proximal end, the anode being coupled to the proximal end and to the central conductor of the coaxial cable, and the cathode being coupled to the distal end;

the catheter further comprises a conductive surface surrounding the tubular insulator, coupling the cathode to the outer conductor of the coaxial cable; and

the insulator and cathode define an annular region proximate the coupling between the cathode and the insulator, the annular region being screened from an electrical field generated between the anode and the cathode by the conductive surface and a portion of the cathode.

45. The catheter of claim 44, wherein the insulator comprises a wall depending from the proximal end of the tubular portion, the wall being angled toward the anode and the vacuum chamber.